National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 3198

Aqueous Electrolytic Conductivity

Lot No. 050803

This Standard Reference Material (SRM) is intended primarily for use in electrolytic conductivity measurement as a calibration standard or control sample. As a calibration standard, it can be used to determine the conductivity cell constant. One unit of SRM 3198 consists of one glass bottle containing approximately 500 mL of a dilute potassium chloride (KCl) solution in a mixture of 30 % (by mass) 1-propanol, 70 % (by mass) water in equilibrium with atmospheric carbon dioxide.

SRM 3198 was prepared gravimetrically using deionized water that was filtered through a 0.22 μm filter. The initial electrolytic conductivity of this water was less than 0.06 μS/cm. The solution was dispensed into borosilicate glass (Pyrex 33®)[1] bottles. The certified electrolytic conductivity and its uncertainty given below were established through determinations with a conductivity cell immersed in a constant temperature oil bath and using a Jones bridge with a null detector. The conductivity bridge and electronics are described elsewhere [1,2].

The certified value, given below, is based on equilibrium conditions, and the solution should **NOT** be degassed before use.

Electrolytic Conductivity at 25.000 °C: 5.20 μS/cm ± 0.20 μS/cm

The uncertainty in the certified value, U = 0.20 μS/cm, is calculated as:

$$U = 1.96\, u_c$$

where u_c is the combined standard uncertainty calculated according to the ISO and NIST Guides [3]. The value of u_c is intended to represent, at the level of one standard deviation, the combined effect of uncertainty components associated with the stability of the SRM, atmospheric pressure, mole fraction of carbon dioxide, measurement of the solution, and cell calibration. The value of u_c has been multiplied by 1.96, which is the coverage factor corresponding to approximately 95 % confidence based on greater than 1000 overall effective degrees of freedom.

Expiration of Certification: The certification of **SRM 3198 Lot No. 050803** is valid, within the measurement uncertainty specified, until **03 August 2006**, provided the SRM is handled in accordance with instructions given in this certificate (see "Instructions for Use"). This certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

This SRM was prepared and analyzed by K.W. Pratt of the NIST Analytical Chemistry Division.

Statistical consultation was provided by W.F. Guthrie of the NIST Statistical Engineering Division.

Stephen A. Wise, Chief
Analytical Chemistry Division

Gaithersburg, MD 20899
Certificate Issue Date: 04 January 2006

Robert L. Watters, Jr., Chief
Measurement Services Division

[1]Certain commercial equipment, instruments, or materials are identified in this certificate in order to specify adequately the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

The support aspects involved with the preparation of this SRM were coordinated through the NIST Measurement Services Division.

Maintenance of Certification: NIST will monitor representative solutions from this SRM lot over the period of its certification. If substantive changes occur that affect the certification before the expiration of certification, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

Conductivity is strongly influenced by temperature, and for this solution, the temperature coefficient at 25 °C, α, is approximately 2.9 % per °C [4]. The certified value and its uncertainty were determined with the temperature at 25.000 °C ± 0.004 °C. The corresponding equation for correcting to other temperatures is

$$\kappa = \kappa_{25°C}\left[1 + \alpha\left(t - 25\,°C\right)\right]$$

where $\kappa_{25\ °C}$ is the certified value, α is 2.9 % (= 0.029), t is the temperature of measurement, and κ is the corrected value at t. This correction is valid in the range of t = 25.0 °C ± 0.5 °C. It should not be applied to values of t outside this range.

INSTRUCTIONS FOR USE

The SRM bottle should be open for the minimum time required to dispense the solution. Each time the bottle is opened, a portion of the solution will evaporate, which will change the conductivity. After use, the bottle should be tightly recapped and stored under normal laboratory conditions away from acid fumes, nitrogen oxides, and sulfur dioxide. These precautions will reduce the evaporation rate of the solute and possible acidic contamination.

REFERENCES

[1] Shreiner, R.H.; Pratt, K.W.; *Primary Standards and Standard Reference Materials for Electrolytic Conductivity*; NIST Special Publication 260-142, U.S. Government Office: Washington, DC (2004).

[2] Wu, Y.C.; Pratt, K.W.; Koch, W.F.; *Determination of the Absolute Specific Conductance of Primary Standard KCl Solutions*; J. Solution Chem., Vol. 18, p. 515 (1989).

[3] ISO; *Guide to the Expression of Uncertainty in Measurement*; ISBN 92-67-10188-9, 1st ed., International Organization for Standardization: Geneva, Switzerland (1993); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297, U.S. Government Printing Office: Washington, DC (1994); available at http://physics.nist.gov/Pubs/.

[4] Wu, Y.C.; Berezansky, P. A.; *Low Electrolytic Conductivity Standards*; J. Res. Natl. Inst. Stand. Technol. Vol. 100, p. 521 (1995).

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-6776; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet at http://www.nist.gov/srm.